

Photographic evidence of Himalayan Serow *Capricornis sumatraensis ssp. thar* (Hodgson, 1831) in Bardia National Park, Nepal

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Abstract

Himalayan Serow (*Capricornis sumatraensis ssp. thar* Hodgson, 1831) believed to be distributed only in Bangladesh, Bhutan, China, India and Nepal, it occurs across the Churia - Himalayan range and has also been detected within the Annapurna Conservation Area, Langtang and Makalu Barun National Park. Recently it was discovered from wider areas than previously thought but never recorded from Bardia National Park (BNP). During a camera trap survey primarily targeted for tigers *Panthera tigris*, Himalayan Serow was photographed multiple times on four camera trap stations in BNP in December 2017 and January 2018. The camera trapped location is in dry-deciduous mixed forest mainly composed of hill Sal *Shorea robusta*, Saj *Terminalia tomentosa* forest in core area of the park at a distance of approximately 15 km from settlements. This is the first photographic evidence of Himalayan Serow captured in BNP, Nepal. Similarly, a Himalayan Serow was rescued in 2013 at Kalinara in the Babai Valley (along the Babai River) of the Park. As stated by the BNP and Buffer Zone Management Plan (2016 – 2020), a total of 56 mammal species are reported from the park and with this record adds one more mammal species in the park. The study revealed that camera trapping targeted at tigers can provide opportunity for getting important information on rare and elusive species. Himalayan Serow co-exist in Bardia with sympatric herbivores like Four Horned Antelope *Tetra cerusquadri*

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cornis, Himalayan Crestless Porcupine *Hystrix brachyuran*, and Sambar *Rusa unicolor* and other animal like Tiger *Panthera tigris* and Sloth bear *Melursus ursinus*.

Keywords: Himalayan serow, camera trapping, sampling effort, encounter rate, rescue

Introduction

The globally threatened Himalayan Serow *Capricornis sumatraensis thar* (Hodgson, 1831) listed in Appendix I of CITES . It is locally called "thar" in the study area, belonging to the family Bovidae and subfamily Caprinae. The Himalayan Serow occurs in steep, rugged, dense forested areas and damp and thickly wooded gorges, preferring elevations of 2,500 m to 3,500 m (Jnawali et al., 2011), but not in the lowland Terai of Nepal. Serow is a solitary animal (Prater, 1993; Schaller, 1977), although sometimes have been seen in a group of up to seven (Prater, 1993; Nowak and Paradiso, 1983). Its population is declining due to decrease in its habitat, hunting for its meat and loss of forest cover due to clearing for agriculture and collection of fuelwood (Green 1987a; Duckworth and MacKinnon 2008). The major threats are hunting for subsistence, habitat fragmentation with incompatible land use changes, human-wildlife conflict due to crop raiding and resource competition with livestock and increased livestock grazing in Serow habitat. Like other mountain ungulates, Himalayan Serow also forms a part of the prey base for carnivores especially leopards. Limited work has been done on the distribution, status and ecology of the Himalayan Serow. The presence of the Himalayan serow has been recorded in east and southeast Bangladesh; in Himalayas (Bhutan, northwestern and northeastern India including Sikkim and Nepal), in China (Tibet only), and probably in western Myanmar (Grubb, 2005). In India, Himalayan Serow is sparsely distributed throughout the forest across Himalayan range starting from Jammu and Kashmir in northwest to the hill states of northeastern India (Prater, 1965).). In Nepal the animal has been recorded in temperate coniferous forests and broadleaved forest (Paudel et al., 2012). There are no accurate estimates of the population size

of the species available in India, but their density in Kedarnath Wildlife Sanctuary (Uttarakhand) has been estimated at 1.6 Serow/km² (Green, 1987a) and in Nepal its density in the Annapurna Conservation Area is estimated at 1.17 individuals/km²(Aryal, 2009).

It is also listed as an Endangered species in Nepal by the Department of National Parks and Wildlife Conservation, Nepal (Chapagai and Dhakal, 2002) and thus, its hunting is prohibited throughout Nepal since 1992 (Wegge and Oli, 1997).

Himalayan Serow has a large head, thick neck, short limbs, long mule-like ears, and a coarse coat of dark hair (Schaller, 1977). Anecdotal information provided by the local villagers to our team during the camera trapping exercise also suggest that they are mainly active during the night and early morning hours. Both sexes are grossly similar in appearance and are about equal size (Schaller, 1977; Aryal, 2008). The species is oriental in origin (Schaller, 1977), and is known to be locally present between 300m and 3,000m elevation in all Himalayan region(Green, 1987b). There have been accounts throughout the species range that it inhabits rugged steep hills and rocky places, especially the limestone regions, and also in hill and mountain forest areas (Duckworth and MacKinnon, 2008). Aryal (2008) found that the Himalayan Serow prefers gentle to steep slopes, while avoiding the plains to stay away from the predators. They use steeper areas as resting places and gentler slopes for grazing (Aryal, 2008). In the Terai Arc landscape, Himalayan Serow have been recorded at elevations of 413m in Nandhaur Wildlife Sanctuary, Uttarakhand and at 172m in Bihar's Valmiki Tiger Reserve (WWF-India unpublished report).

Himalayan serow has never been reported from Bardia National Park (BNP) before, de-

spite extensive camera trapping ongoing for tiger monitoring since 1990s in the park. Here we report the first time photographic evidence of the Himalayan serow from the BNP in Nepal.

Materials and Methods

a. Study area

The study was conducted in the Bardia National Park (BNP), the second largest tiger bearing national park in the low land Terai of Nepal. The park is within the Terai in southwestern Nepal (28.7193 to 29.0515°N; 80.0609 to 80.4120°E). The park is linked to the Katarniyaghat Wildlife Sanctuary of India to the South. To the east it is connected with Banke National Park and to the North the park is border to Chure and Mahabharat range. It is one of the national park in Nepal to be registered and accredited as Conservation Assured Tiger Standards (CA | TS) site. This is an accreditation scheme that encourages protected areas where tigers are found to meet a set of standards and criteria created by an international group of experts and protected area managers that assure effective and long term tiger conservation. The area has three distinct seasons viz. monsoon, winter and summer and the mean monthly temperature ranged from 100C to 400C and average annual rainfall reach up to 1800mm.

The park is drained by two major river systems (Karnali and Babai) and their tributaries. Karnali river and its floodplains in southwestern part of Bardia have highly productive alluvial grasslands and riverine forests which support high density of ungulates (Wegge et al., 2009). These rivers and their tributaries provide ample amount of water for the wildlife in the forest. Babai River passes through the valley in eastern part of the park. The valley comprises different habitats such as riverine forests, tall grasslands, wooded grasslands, mixed hardwood forest, water bodies, sandy banks,

sal forest and short grassland. The Babai valley contains chure hills to the north with steep hills, deep valleys, multiple rocky streams (raus) and some perennial rivers. The hill slopes which are both densely wooded, and have patches of grass provide suitable habitat for Serow and goral (*Naemorhedus goral*) (Aryal, 2008). The park provides habitat for rare and globally threatened species such as greater one-horned rhinoceros *Rhinoceros unicornis*, tiger *Panthera tigris*, elephant *Elephas maximus*, sloth bear *Melursus ursinus*, Asiatic black bear *Ursus thibetanus*, striped hyena *Hyaena hyaena*, dhole *Cuon alpinus* and fishing cat *Prionailurus viverrinus*.

b. Camera Trapping

As part of tiger monitoring in the western Terai complex, a camera trapping survey was conducted in the entire Bardia National Park (968km²) and the adjoining forest patches from December 2017 to February 2018; (Fig. 1). The entire area was divided into 418 grids of 2x2 km² out of which 362 grids (87%) were surveyed in two shifts (blocks) consecutively. Fifty six grid cells were not surveyed due to the inaccessibility of the terrain or difficulty to find suitable location for camera traps. The camera trap location within each grid was selected following an extensive survey of tiger signs. In each sampling point a pair of motion sensor camera traps (Cuddeback Color Model C1, Cuddeback Attack, Reconyx 500, and Reconyx 550) was installed at 45–60 cm above ground on either side of the game trail, forest road or stream bed, maximizing the possibility of tiger capture. Camera traps were checked every alternate day to observe the photographs of tiger and other species captured on the previous nights. Cameras were active for a minimum of 15 days in each sampling location. Camera trap photos were given unique identification names and sorted species-wise in separate folders. Photos obtained at one-hour intervals at the same camera location were considered as independent detections.

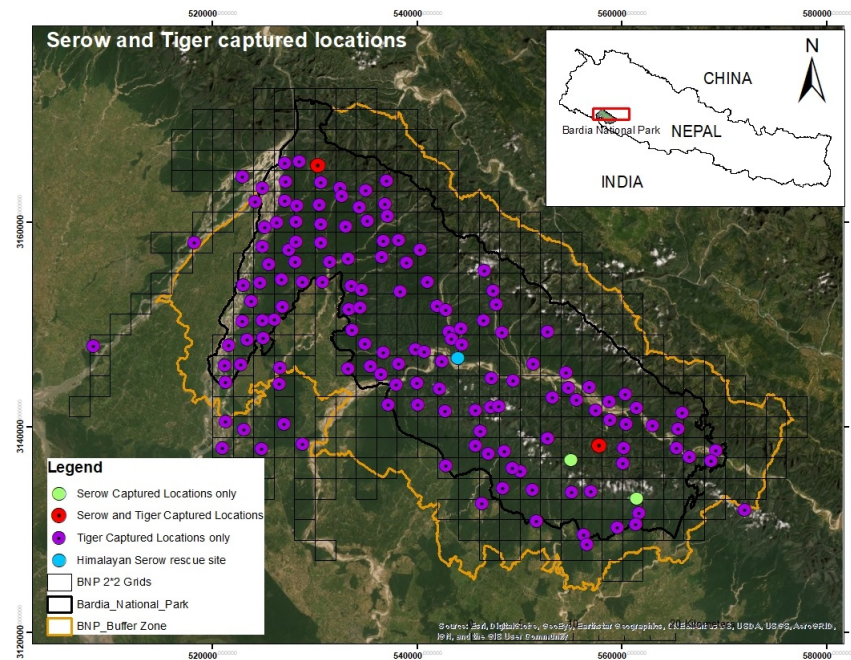


Figure 1. Red circle with black dot indicate Himalayan Serow captured with tiger, yellow circle indicate only Himalayan Serow captured and sky blue circle indicating rescued site of the Himalayan Serow

c. Opportunistic sighting of Himalayan Serow

A joint patrol team of BNP found the sub adult Himalayan serow floating in Babai River in July 2013 at Kalinara in Babai valley of the park. It was rescued from river and sent to

a park headquarters. The animal with multiple injuries on its body was treated and later based on decision, the animal was sent to Central Zoo, Kathmandu for further research and exhibition for education.

Table 1. Details of Camera traps locations of Himalayan Serow in Bardia National Park in National Tiger and Prey Base Survey 2018

	BNP	BNP	BNP	BNP
Particulars	Camera Trap Grid ID No.AC20	Camera Trap Grid ID No.M04	Camera Trap Grid ID No. Y19	Camera Trap Grid ID No.Z18
GPS	561395,3133077	530292, 3165507	555016, 3136824	557782, 3138172
Elevation in meter	493 m	374 m	403 m	335 m
No. of photo (Video)	6 (0)	3 (0)	2 (0)	3 (0)
No. of in- dividuals	1	1	1	1
Duration of Cam- era Trap	2018-01-06 to 2018- 01-22	12-18-2017 to 01-03- 2018	2018-01-05 to 2018- 01-22	2018-01-05 to 2018- 01-18
Photo Captured date and time	2018-01-20 (07:23:47 to 07:23:51)	2017-12-31 (10:49:53 to 10:49:57)	2018-01-10 (20:03:45 to 20:03:56)	2018-01-14(12:25:12 to 12:25:15)
Habitat type	Mixed Forest composed of	Mixed Forest composed of Sal	Riverine forest	Mixed Forest composed of Sal
Nearest distance to village (km)	Sal <i>Shorea robusta</i> , Saj <i>Terminalia tomentosa</i> , Bot <i>dhairo Lager-</i> <i>stroemia parviflora</i> , Bans, Bhorla <i>Bauhinia vahlii</i> and <i>Bauhinia</i> Spp.	<i>Shorea robusta</i> , Saj <i>Terminalia tomen-</i> <i>tosa</i> , Bot <i>dhairo</i> <i>Lagerstroemia parvi-</i> <i>flora</i> , Bans, Bhorla <i>Bauhinia vahlii</i> and <i>Bauhinia</i> Spp.		(<i>Shorea robusta</i>), Saj (<i>Terminalia tomen-</i> <i>tosa</i>), Bot <i>dhairo</i> (<i>Lagerstroemia parvi-</i> <i>flora</i>), Bans, Bhorla <i>Bauhinia vahlii</i> and <i>Bauhinia</i> Spp.
Distance to nearest tiger captured locations (km)	1.90	Same Locations 3.25	Same Locations	
Other mammal species captured on the same station	Four Horned An- telope (<i>Tetracerus</i> <i>quadricornis</i>) Indian Crested Porcupine (<i>Hystrix indica</i>)	Royal Bengal Tiger (<i>Panthera tigris</i>), Tarai Gray Langur (<i>Semnopithe-</i> <i>cus hector</i>)	Sambar Deer (<i>Rusa unicolor</i>), Sloth Bear (<i>Melur-</i> <i>sus ursinus</i>), Indian Crested Porcupine (<i>Hystrix indica</i>), Terai Gray Langur (<i>Semnopithecus</i> <i>hector</i>). Common Green Magpie (<i>Cissachinensis</i>)	Royal Bengal Tiger (<i>Panthera</i> <i>tigris</i>)



Figure 2. The corresponding author doing the care of rescued Himalayan Serow at the Headquarters in the BNP

Results and Discussion

Opportunistic sighting of Himalayan Serow *A joint patrol team of BNP found the sub adult Himalayan serow floating in Babai River*

A joint patrol team of BNP comprised of Nepal Army and the front line staff of the park rescued a sub adult solitary Himalayan serow in 2013 from Kalinara while patrol team was deployed for monitoring the illegal threats. It was suspected that the animal was swept away by River during monsoon in 2013. It was rescued and brought to headquarters of the Park at Thakurdwara. Later the animal was sent to central zoo in Kathmandu. Unfortunately, it died due to unfavorable habitat. The location from where the serow was rescued is a biodiverse habitat tract in the Shiwalik - Lower Himalayan ecoregion within Nepal's Terai Arc Landscape.

Camera Trapping

We also recorded the Himalayan serow from four locations in the Babai valley of the BNP during extensive camera trapping survey of the iconic tiger in 2018 (Table 1 and Figure 1). Before 2018, this species was never been photographed in BNP. Regular monitoring of high-profile species like tiger provides an op-

This area serves as a crucial wildlife corridor for tigers, elephants, rhino and other animals and facilitates their movement between Babai valley and Karnali Flood Plain within the park. The rescued site is located at latitude 28.448781 and longitude 81.449379 and elevation of 202m in pristine valley of the park. Habitat features of the rescue site included moist deciduous hill forests dominated by *Shorea robusta*, *Haldina cordifolia*, *Acacia catechu*, *Lantana camara*, and *Murraya koeingii*.

Previously, Himalayan Serow has never been recorded in the BNP. In the national distribution, the Himalayan Serow occurs across the Churia - Himalayan range between elevations of 500 m and 3,050 m (Jnawali et al. 2011) but this is the first record below the 500m in the low land.

portunity to discover and record cryptic and elusive species for example camera trapped record of Himalayan Black bear in the BNP (Yadav et al 2017), rusty spotted cat in the BNP and Shuklaphanta National Park (Lamichhane et al 2016) and Ruddy mongoose in the Banke National Park (Subba et al 2014). We compared the captured photographs obtained in camera



Figure 3. Himalayan Serow in camera traps grid BNP-0M04. The background habitat included rough terrain with rugged steep slope

traps with Himalayan serow photos of IUCN Red List of Threatened Species (Kamler et al. 2015) and the National Red List of Mammals

of Nepal (Jnawali et al. 2011) and confirmed its identification.

The serow was captured in four different locations with multiple recaptures ($n=14$) with a total search effort of 5,430 traps night within 362 camera traps grids in the BNP. The detection rate of the Himalayan serow within BNP and BZ was 0.25/100 camera trap nights. Two captures were made in the morning between 7:00AM and 10:00 AM and two captures were made between 8:00 PM and 8:30PM...The captured locations was in rugged terrain with steep cliff with vegetation categorized dry-deciduous mixed forest mainly composed of hill Sal *Shorea robusta*, *Saj* *Terminalia tomentosa* forest in core area of the park at a distance of approximately 15 km from settlements (Table 1). The camera trapped photographs showed that the animal have a coat of grey or dark grey color hair with backward pointing horns with narrow tips.

Based on the locations of the camera trapped Himalayan serow, we assume that the animal might have come from the northern area with upper temperate conifer forest bordering the BNP being by far the preferred habitat for the serow (Poudel et al 2012). Now the

question is what is the size of the population, whether the animal are resident or are showing seasonal movement between sub-tropical dry-deciduous mixed forest in the Babai valley and upper temperate conifer forest. An intensive monitoring of the Himalayan serow is required to understand their status in the BNP. Being an understudied species, the evidence for the presence of the Himalayan Serow's in the BNP opens a scope for further studies and highlights the need for comprehensive conservation efforts to ensure the persistence of the endangered species and their habitats. Furthermore, this might add important insight on the prey-base biomass of the iconic tigers of the Babai valley in the BNP.

Conclusion

This photographic evidence of this species provide proof of occurrence and one more added in mammal list of this national park. So it has now 57 mammal species. A further ecol-

ogy study of this species is more important in future.

Acknowledgments

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Conflicts of Interest

The authors declare that there is no conflicts of interest.

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